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holland river basin

1969

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WATER USE

STUDY

HOLLAND RIVER BASIN

August, 1969

PREFACE

In this report, the findings of an investigation to determine the extent and magnitude of water pollution in the tributaries and main stem of the Holland River are presented. Material inputs from various sources within the basin were measured. Particular attention was paid to the effects of wastewater discharges from the Aurora and Newmarket areas.

A mathematical model of oxygen conditions in the stream from Aurora to Newmarket was developed and based on this model, estimates of acceptable waste loadings under critical summer low flows were made. Using this information, waste loading guidelines for the towns of Aurora and Newmarket are recommended.

Nitrogen and phosphorus loadings from several sources within the basin were measured and the effects of over-enrichment on the stream noted. Methods to alleviate the nutrient enrichment problem from both municipal and agricultural sources are discussed.

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CHAPTER I

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Water quality in the Holland River Basin is affected primarily by wastewater discharges from municipal and industrial sources and to a lesser degree by land drainage. The key conclusions of this investigation are:

1. The discharge of wastes from the Town of Aurora sewage treatment plant and the periodic overflows from the Choice Cut-up Chicken industry seriously impair water quality in Aurora Creek.

2. Elimination of the overflow wastewater discharges from Choice Cut-up Chicken and restriction of the BOD_5 concentration in the Aurora municipal plant effluent to 10 mg/l can be expected to produce satisfactory dissolved oxygen conditions in the stream. This can be achieved by a two-thirds reduction of the BOD_5 load (650 lbs per day) presently discharged. With the effluent objective of 10 mg/l BOD_5, the municipal plant could be increased up to a capacity of 3.0 mgd. In addition, as the optimum solution to the waste disposal problem of St. Andrews College, the wastes from the College should be directed to the Aurora sewerage system.

3. The discharge of treated wastewaters from the Newmarket sewage treatment plant in combination with the residual organic load from Aurora reduce dissolved oxygen levels

to a minimum of 0.2 mg/l. It is concluded that the BOD_5 loading from the Newmarket sewage treatment plant which presently averages about 280 pounds of BOD_5 per day, should not be allowed to exceed 100 pounds per day during the summer low flow period. This will require improved waste treatment to protect the stream and its uses during the period from May to October each year. At other times, secondary sewage treatment is adequate.

With expansion in the Newmarket area and the limitation in BOD removal efficiency attainable with current waste treatment technology, alternative measures for the preservation of water quality may be required for future population increases. An investigation into the possible yields available from streamflow augmentation should be considered.

4. Nutrient enrichment in the Holland River basin is caused mainly by municipal wastewater discharges. Water quality data collected in the upper reaches of the Holland and Schomberg rivers demonstrates that these primarily agricultural areas contribute significantly to the nitrogen and phosphorus concentrations in the watercourse. The nutrient enrichment problem can be greatly alleviated with the incorporation of nutrient removal facilities in municipal waste treatment plant designs. To further lower nutrient levels, the agricultural industry should take measures to reduce the possibility of excessive nutrient additions from land drainage in the intensive land use areas.

RECOMMENDATIONS

1. Waste discharges from the Aurora and Newmarket areas should be reduced to meet the guidelines presented in this report. Briefly, these guidelines are:

(i) Waste treatment at the Aurora sewage treatment plant should be improved to ensure an effluent quality of 10 mg/l BOD_5. At this level of treatment the capacity of the municipal sewage treatment plant should be limited to 3.0 mgd.

(ii) The provision of effluent polishing facilities at Newmarket to reduce the organic loading to about one-third of its present level. This treatment should be maintained during the period from May to October each year.

(iii) Intermittent overflows from Choice Cut-up Chicken should be eliminated.

2. Early consideration should be given to the installation of nutrient removal facilities at municipal waste treatment plants within the basin. In the highly developed agricultural areas of the basin, measures should be taken to reduce the possibility of nutrient enrichment through land drainage from fertilized lands.

3. An investigation should be made into water yields available through streamflow augmentation which may be required to supplement future sewage treatment needs for the municipalities in the upper reaches of the Holland River.

CHAPTER II

WATER QUALITY EVALUATION

The Holland River drains approximately 80 square miles of the north-central portion of the County of York. Aurora Creek rises southwest of the Town of Aurora and passes through the town to its confluence with the Holland River about two miles north of Aurora.

The major water uses of Aurora Creek and Holland River are waste disposal and recreation. The latter applies to the lower Holland River basin downstream from Holland Landing. Limited live-stock watering occurs in the basin. The Town of Aurora is served by a 1.83 mgd (3.7 cfs) activated sludge contact stabilization plant which discharges to Aurora Creek. The sewage flow in 1968 was approximately 2.8 cfs. Wastes from Choice Cut-up Chicken are pumped into Aurora's sewerage system; however, overflows to Aurora Creek, through a small outfall have been noted on several occasions. An activated sludge sewage treatment plant (0.04 mgd) serving St. Andrews College discharges via a swamp to Aurora Creek about one mile downstream from the Aurora municipal plant.

At Newmarket a 2.0 mgd (3.7 cfs) activated sludge sewage treatment plant, operated by the OWRC, serves the town and portions of the Township of East Gwillimbury. The effluent from the plant was dis-charged to the Holland River at an average rate of 3.0 cfs during 1968.

The Town of Bradford is served by a waste stabilization pond which discharges to a marsh draining to the Schomberg branch of the Holland River.

FIELD INVESTIGATIONS

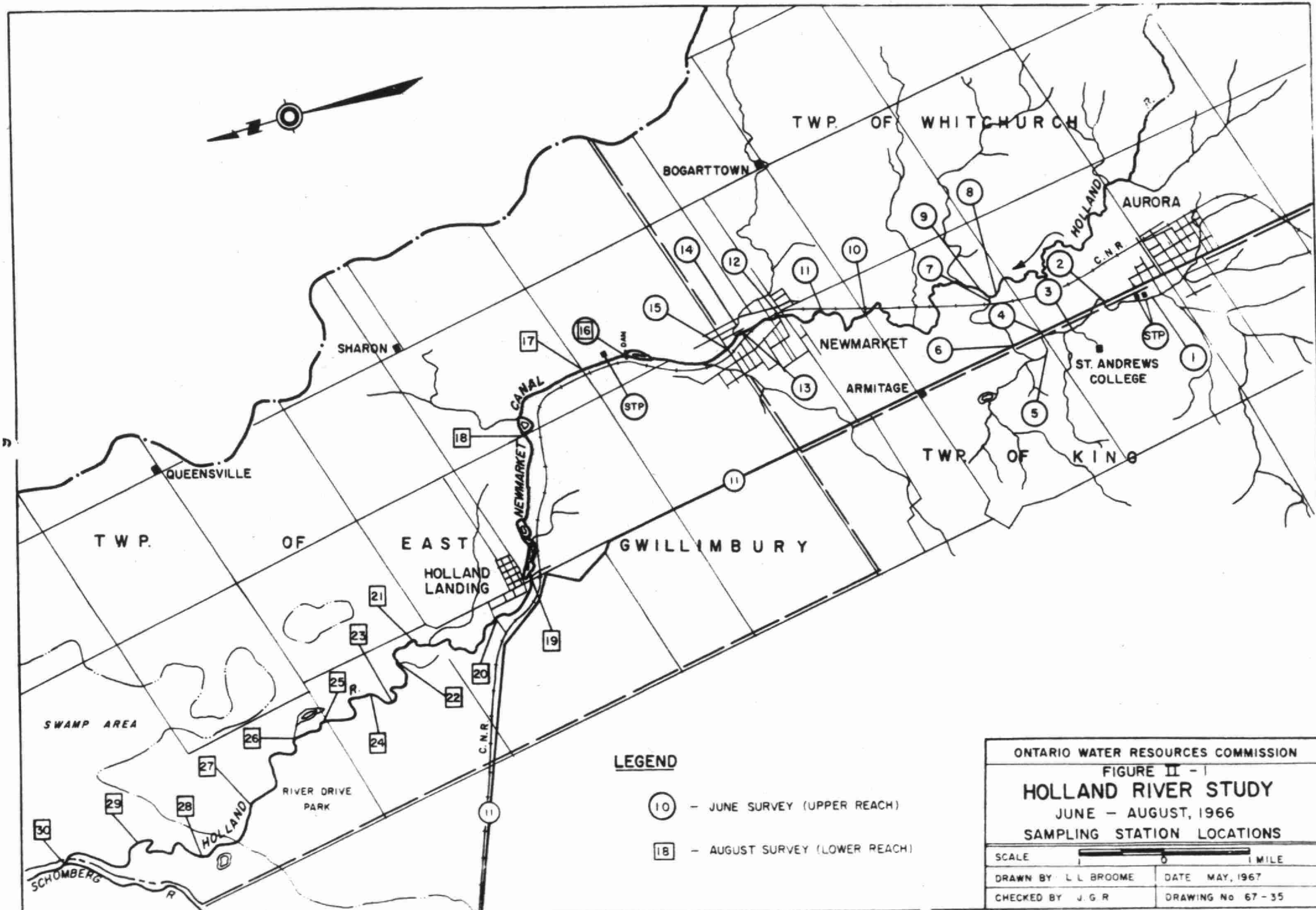
With the establishment of five water quality monitoring stations in the basin, water quality in the Holland River has been observed closely since 1964. In 1966, detailed assessments of the two most seriously affected reaches were also carried out.

In June 1966, a 48-hour intensive survey of Aurora Creek, commencing just upstream from the treatment plant and extending downstream six miles to a point about one mile north of the Town of Newmarket, was carried out. The second study covered a 48-hour period in August, 1966 commencing at a point directly upstream from the Newmarket treatment plant to the confluence with the Schomberg River. Survey station locations are set out in Figure II-1. Subsequent work in 1967 and 1968 included regular water quality monitoring at five sampling stations including one station on the Schomberg River at Bradford.

DISCUSSION OF RESULTS

Waste Inputs and Water Quality

Grossly polluted conditions were observed in 1966 immediately downstream from Aurora in Aurora Creek as reflected by excessive BOD_5 concentrations, low dissolved oxygen levels and


TWP. OF WHITCHURCH
BOGARTTOWN
AURORA
HOLLAND R.
C.N.R.
STP
NEWMARKET
ST. ANDREWS COLLEGE
ARMITAGE
TWP. OF KING
SHARON
CANAL
DAM
NEWMARKET
QUEENSVILLE
TWP. OF EAST GWILLIMBURY
HOLLAND LANDING
SWAMP AREA
RIVER DRIVE PARK
HOLLAND
SCHOMBERG R.
C.N.R.
LEGEND
10 - JUNE SURVEY (UPPER REACH)
18 - AUGUST SURVEY (LOWER REACH)
ONTARIO WATER RESOURCES COMMISSION
FIGURE II - 1
HOLLAND RIVER STUDY
JUNE - AUGUST, 1966
SAMPLING STATION LOCATIONS
SCALE 1 0 1 MILE
DRAWN BY L. L. BROOME
DATE MAY, 1967
CHECKED BY J. G. R.
DRAWING No 67 - 35

excessive nutrient concentrations. The Aurora sewage treatment plant and Choice Cut-up Chicken discharged loadings of 550 and 570 lbs BOD_5 per day respectively during the survey. The swamp receiving the waste discharge from St. Andrews College had no discharge to the creek during the survey.

The above loadings elevated average BOD_5 values to about 27 mg/l and maximum values as high as 110 mg/l were measured. Dissolved oxygen was lowered to values which approached septic conditions. The impaired water quality was confirmed by subsequent sampling in 1967-68 which is not unexpected since the municipal waste inputs have been increasing since 1966. By comparison, over the 1967-68 period, the average BOD_5 loading (which includes by-passed raw sewage) from the Aurora plant amounted to about 650 lbs per day. The Choice Cut-up Chicken plant continued to discharge to Aurora Creek periodically despite efforts by the industry to eliminate this pollution source.

Although there was no discharge from St. Andrews College at the time of the 1966 survey this condition will be altered since the swamp receiving the wastewater from the college is being filled in. As a result these wastes will not have the benefit of natural purification in the swamp before they reach Aurora Creek. Based on effluent sampling the BOD_5 load to the creek from this source can be expected to be about 30 lbs per day.

The Aurora area waste inputs produce residual impairment of water quality in the vicinity of Newmarket (average BOD_5 for period 1964-68 - 8.2 mg/l; minimum dissolved oxygen concentration - 3.0 mg/l). With this residual load in the stream and the organic loading from the Newmarket treatment plant (period 1967-68, average BOD_5 loading - 280 lbs per day), the water quality becomes seriously impaired below Newmarket. The in-stream BOD_5 level of 140 lbs per day in 1966 reduced the dissolved oxygen content to a minimum of 0.2 mg/l at Station 18 (bridge on Concession 1 East, Township of East Gwillimbury).

Nutrient enrichment of the Holland River is at a level sufficient to sustain the growth of algae throughout the basin extending into Cook Bay of Lake Simcoe. The effects of this enrichment are particularly noticeable in Fairy Lake at Newmarket, where the algae-choked water renders the lake useless for recreation.

The municipal waste treatment plants contribute most significantly to the nutrient load. The Aurora sewage treatment plant discharged nitrogen and phosphorus loadings in the order of 390 lbs per day of total nitrogen as N and 104 lbs per day of phosphorus as P. Similarly, the Newmarket plant discharged about 90 lbs per day of total nitrogen and 100 lbs per day of total phosphorus. The comparatively high nitrogen loading from the Aurora treatment plant can be

attributed to waste discharges from various industries served by the Aurora sewerage system. Nutrient loadings are not available for the Bradford municipal lagoon.

In the headwaters of the Holland River above Aurora, the total nitrogen and phosphorus loads carred by the stream were measured at 1.19 mg/l and 0.17 mg/l respectively (15.3 and 2.2 lbs per day respectively). In the highly developed agricultural area drained by the Schomberg River, water quality monitoring records indicate a total nitrogen level in the stream of 1.6 mg/l (350 lbs per day) and a total phosphorus level of 0.21 mg/l (50 lbs per day). Because these regions are primarily rural with no significant municipal discharges, nutrient loadings can be attributed to nitrogen and phosphorus materials carried by surface runoff and sub-surface drainage.

Excessive coliform levels were found below the Aurora treatment plant with average values as high as 438,000 organisms per 100 ml. This probably is the result of the discharge of by-passed raw sewage, a condition which has been virtually eliminated by the recent modifications at the Aurora sewage treatment plant. Further downstream the bacteriological quality improved considerably and all samples collected in Fairy Lake fell below 1,000 organisms per 100 ml. The average coliform levels in the stretch downstream from Holland Landing did not exceed 400 organisms per 100 ml. This part of the river is used ex-

tensively for recreation.

Two water quality monitoring stations are located below the Aurora sewage treatment plant, two below the Newmarket plant and one on the Schomberg branch. The information collected at the five stations since 1964 confirmed the gross water quality impairment found in 1966. High levels of nutrients together with depressed dissolved oxygen concentrations and elevated BOD values were noted. A summary of the data for the period 1964-68 is presented in the Appendix.

CHAPTER III

POLLUTION CONTROL PLAN

AURORA CREEK

Based on the conditions listed below, a mathematical relationship, described graphically in Figure III-1, was used to arrive at an estimate of the acceptable organic waste loading that could be discharged to the stream from the Town of Aurora.

- 7-day low streamflow of 0.8 cfs with a 5 per cent chance of occurrence in Aurora Creek just above the Aurora treatment plant outfall;
- stream water temperature of 25°Centigrade;
- dissolved oxygen not less than 4.0 mg/l.

Because of the high reaeration capacity of the stream, the dissolved oxygen level of 4.0 mg/l could be obtained with an effluent loading of 320 pounds per day (BOD_5). However, this would result in BOD levels in the stream of 20 mg/l and no improvement in the esthetic conditions of the creek in the northern part of the town. In order to achieve a BOD level of 10 mg/l believed to be necessary for esthetic reasons, the plant effluent should be reduced from the present loading of 650 pounds per day to a level of 200 pounds per day. This reduction would result in a BOD content of the stream of 4.0 mg/l at its confluence with the Holland River.

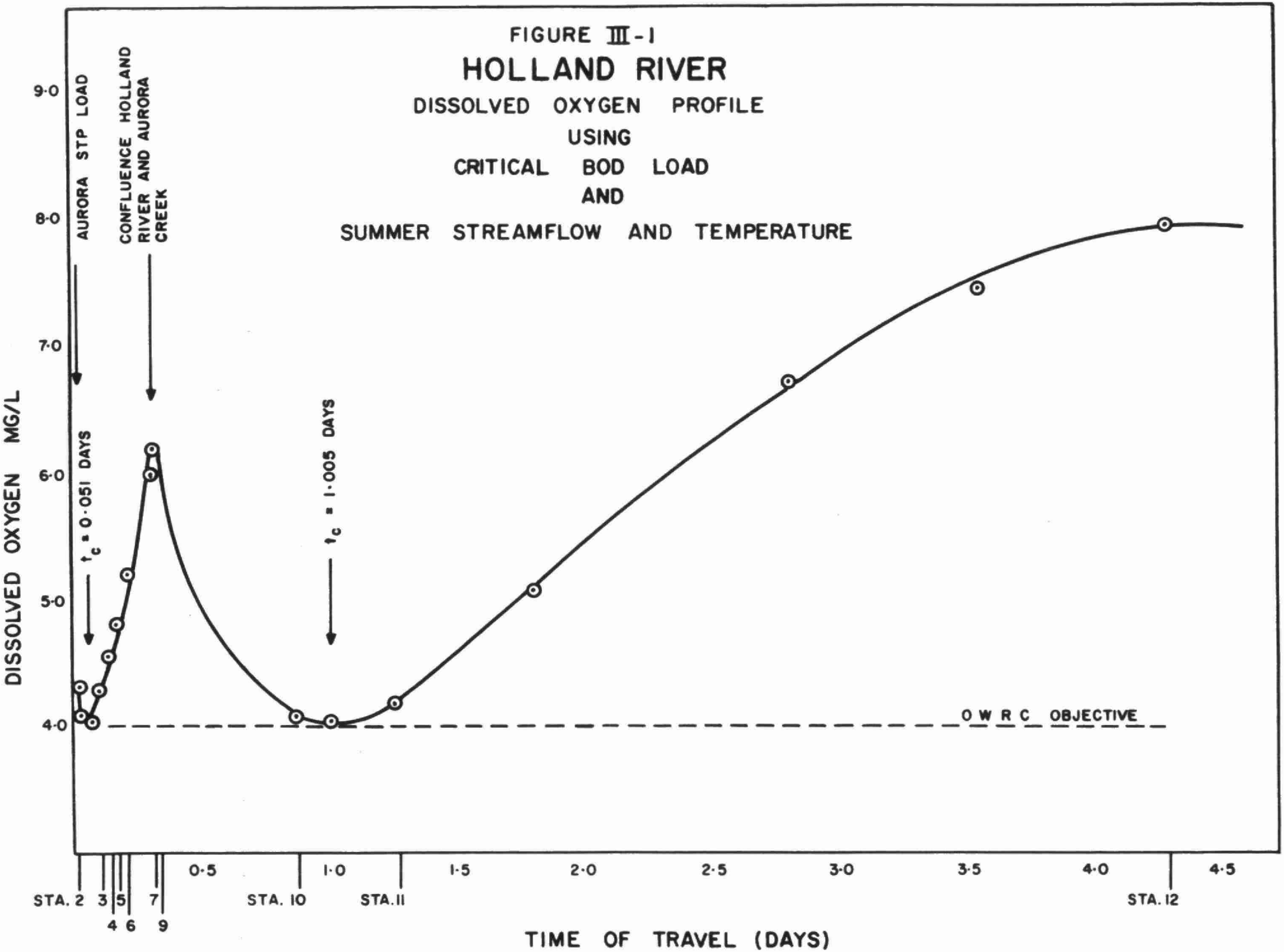


FIGURE III-1
HOLLAND RIVER
DISSOLVED OXYGEN PROFILE
USING
CRITICAL BOD LOAD
AND
SUMMER STREAMFLOW AND TEMPERATURE
AURORA STP LOAD
CONFLUENCE HOLLAND RIVER AND AURORA CREEK
t_c = 0·051 DAYS
t_c = 1·005 DAYS
O W R C OBJECTIVE
DISSOLVED OXYGEN MG/L
9·0
8·0
7·0
6·0
5·0
4·0
0·5
1·0
1·5
2·0
2·5
3·0
3·5
4·0
4·5
STA. 2
3
4
5
6
7
9
STA. 10
STA. 11
STA. 12
TIME OF TRAVEL (DAYS)

Waste treatment at St. Andrews College requires substantial improvement and accordingly, the Commission has recommended that the college obtain a connection to the Aurora sewerage system. Such an arrangement would eliminate one waste discharge to the creek and provide more efficient treatment of the sewage from the college.

With the increasing subdivision development in the Town of Aurora, the population of the municipality and associated waste flows are expected to increase rapidly. Since the stream has a limiting capacity to accept waste loads, a very high degree of sewage treatment is essential at the Aurora municipal plant. With an effluent quality of 10 mg/l BOD_5, and assuming connection of the St. Andrews facilities to the Aurora sewerage system, the Aurora plant could be expanded to a capacity of 3.0 mgd. At this capacity, the total BOD_5 input would be in the order of 300 pounds BOD_5 per day and acceptable water quality in the stream would be ensured.

HOLLAND RIVER BELOW NEWMARKET

The combination of waste inputs from Aurora and the Town of Newmarket impose organic and nutrient loadings on the Holland River downstream from the Newmarket plant and produce the undesirable water quality problems described earlier. With im-

plementation of the pollution control measures needed to protect Aurora Creek, water quality should improve in the Newmarket area.

In November 1968, the Holland River Conservation Authority reactivated an old dam about two miles downstream from the plantwhich has resulted in a back-up of water as far as the Newmarket plant. The changed nature of the river, viz., reduced flow velocities, will reduce the reaeration characteristics and lead to some reduction in the natural purifying capability of the stream. In the light of these changes in the stream, it is estimated that the waste load input at Newmarket should probably not exceed 100 lbs of BOD_5 per day from May to October when streamflows are lowest and water temperatures highest. This restriction will require the provision of effluent polishing facilities during this period. At other times, secondary treatment can be expected to provide the necessary protection for the stream. By 1980, the population of Newmarket is expected to increase to 18,000 (1). The estimate does not take into account recent plans of the municipality to annex land which would double the town's land area. Increased BOD loadings associated with the expanding population will require even greater BOD removal efficiencies if satisfactory water quality conditions are to be maintained in the stream.

Since there are definite limitations in the degree of waste treatment attainable with present technology, flow augmentation

should be considered to serve the needs of future increases in population. A study to determine the flow augmentation potential of the watershed should be conducted unless further improvement in waste treatment technology can be attained.

NUTRIENTS

Although nutrient removal has not been practical until recently, recognition of the need for this additional treatment of sewage is growing. While it is known that both nitrogen and phosphorus are required to promote the growth of aquatic plants, control of phosphorus inputs or discharges appears to be the most practical approach to the control of the over-enrichment problem. An appreciable reduction of phosphorus in municipal sewage effluents can be obtained using known chemical treatment methods. This additional waste treatment should be applied to the significant municipal sources of phosphorus in the basin.

In the highly developed agricultural areas of the basin, measures should be taken to reduce sources of nutrients contributed by land drainage and eroded soils.

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(1) Ontario Department of Municipal Affairs, Community Planning Branch

APPENDIX

SUMMARY OF

WATER QUALITY DATA

1964 - 1968

TABLE 1

SUMMARY OF DISSOLVED OXYGEN DATA - 1966

	STATION	AVG TEMP °C	D.O. CONCENTRATION (mg/l) AVG.	MAX.	MIN.	AVG. D.O. DEFICIT (mg/l)	POUNDS/ DAY
UPPER REACH	1	20.5	8.0	10.6	6.0	1.1	16.1
	2	20.2	5.6	7.0	4.6	3.6	99.3
	3	20.4	4.8	7.4	2.8	4.3	147.3
	4	20.3	4.1	6.2	2.0	5.0	182.
	5	20.5	3.4	6.0	1.0	5.7	208.
	6	20.6	3.1	8.7	0.5	5.9	207.
	7	22.0	5.7	13.0	0.0	3.1	99.
	8 (T)	21.3	8.2	11.6	5.9	0.7	9.
	9	21.1	6.2	12.4	1.4	2.8	123.2
	10	22.3	3.4	7.2	0.4	5.4	218.
	11	23.1	4.4	11.8	2.2	4.2	204.
	12	22.7	7.6	11.0	6.0	1.2	60.
	13	22.8	5.8	8.8	3.5	2.9	146.
	14 (T)	22.9	6.7	10.2	5.0	2.0	20.7
	15	22.7	5.7	10.8	2.8	3.0	169.
	16	23.7	6.9	11.8	2.0	1.6	91.
LOWER REACH	16	20.8	6.2	6.6	5.5	2.8	65.7
	17	21.0	3.9	5.2	2.7	5.1	185.
	18	19.0	2.2	4.4	0.2	7.2	272.
	19	19.6	7.3	12.8	2.4	1.9	74.
	20	19.5	5.2	6.5	3.6	4.0	157.7
	21	20.2	5.2	8.3	3.4	4.0	-
	22	20.9	6.3	11.4	3.3	2.6	-
	23	22.4	12.6	18.0	7 0	* 3.8	-
	24	22.4	14.9	25.0	6.8	* 6.1	-
	25	22.4	14.0	23.8	11.0	* 5.2	-
	26	22.4	10.6	14.0	6.5	* 1.9	-
	27	22.9	8.1	11.6	5.4	0.6	-
	28	22.1	7.9	10.0	6.0	0.9	-
	29	22.1	8.1	10.0	5.7	0.8	-
	30	21.8	7.3	10.2	4.8	3.1	-

(T) - Tributary Stream
* - Dissolved Oxygen Surplus

TABLE 2

SUMMARY OF BIOCHEMICAL OXYGEN DEMAND DATA - 1966

	STATION	5-DAY BOD CONCENTRATIONS (mg/l)			BOD_5	AVERAGE CARBONACEOUS BOD
		AVG.	MAX.	MIN.	POUNDS/DAY	(mg/l)
UPPER REACH	1	4.0	7.0	2.1	58.5	2.2
	2	37.8	110.	9.4	1043	17.8
	3	37.1	112.	8.6	1262	14.8
	4	26.1	76.	8.4	951	11.6
	5	19.9	66.	7.2	725	10.4
	6	15.1	54.	7.1	531	10.9
	7	8.1	16.	4.2	251	7.6
	8 (T)	2.5	3.6	1.9	32.5	1.5
	9	7.2	11.0	5.2	317	5.1
	10	9.3	14.0	4.4	377	2.7
	11	9.8	13.0	5.0	476	3.0
	12	13.4	16.0	8.4	669	3.8
	13	14.7	18.0	12.0	742	4.1
	14 (T)	3.3	4.4	2.3	34.6	1.7
	15	13.5	16.0	10.2	763	4.1
	16	8.7	12.0	5.0	493	3.3
AURORA STP	South Outfall	48.2	115.	1.	260	32.7
	North Outfall	16.9	33.	5.6	293	21.1
Choice Cut-Up Chicken	Outfall to Hwy 11	528.	675.	365.	571	495
LOWER REACH	16	2.6	3.1	2.2	61.0	1.1
	17	3.8	6.3	2.2	138.3	1.4
	18	3.6	11.	1.1	136.	1.7
	19	3.3	4.4	2.4	128.	1.2
	20	4.8	9.5	2.0	189.	1.9
	21	6.9	17.	3.0	157.7	3.2
	22	4.7	9.0	3.6	-	2.3
	23	18.5	26.	7.6	-	12.8
	24	24.0	44.	10.8	-	15.4
	25	17.5	27.	12.	-	11.6
	26	12.1	14.	11.	-	7.9
	27	8.7	11.	5.2	-	5.9
	28	8.5	11.	5.0	-	6.8
	29	9.8	14.	5.4	-	6.8
	30	10.4	17.	6.	-	7.4
Newmarket STP	Outfall	4.9	8.0	2.8	63.5	3.1

TABLE 3

SUMMARY OF NUTRIENT DATA (mg/l) - 1966

	STATION	PHOSPHORUS AS PO4		NITROGEN AS N			
		TOTAL	SOLUBLE	FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE
UPPER REACH	1	0.80	0.26	0.18	0.62	0.015	0.20
	2	8.2	6.3	7.2	15.6	0.17	0.08
	3	9.3	7.2	7.4	15.7	0.05	0.04
	4	8.9	7.4	7.6	14.5	0.33	0.05
	5	7.3	6.4	7.7	13.9	0.13	0.08
	6	7.9	6.6	7.1	12.5	0.07	0.08
	7	5.8	5.5	7.9	12.2	0.10	0.07
	8 (T)	0.5	0.1	0.23	1.0	0.01	0.18
	9	4.5	4.3	4.6	6.0	0.09	0.13
	10	2.8	2.4	3.39	4.3	0.36	0.13
	11	2.5	2.28	3.61	4.1	0.28	0.15
	12	1.73	1.13	2.84	4.13	0.25	0.20
	13	1.86	1.31	2.13	3.2	0.39	0.5
	14 (T)	0.54	0.41	0.27	1.38	0.02	0.22
	15	1.93	1.61	1.51	2.73	0.35	0.41
	16	1.31	1.01	1.35	2.83	0.32	0.43
LOWER REACH	16	4.33	4.13	1.74	4.7	0.09	0.35
	17	11.1	9.93	1.17	3.46	0.33	1.9
	18	9.5	8.73	0.71	2.50	0.21	2.08
	19	8.40	7.6	0.34	1.73	0.17	1.63
	20	7.33	6.33	0.34	1.95	0.13	1.53
	21	5.8	5.1	0.27	1.77	0.06	0.62
	22	6.2	4.6	0.26	2.24	0.07	1.09
	23	4.8	3.38	0.31	5.63	0.09	0.48
	24	5.0	2.8	0.25	4.35	0.08	0.18
	25	3.9	2.38	0.22	4.28	0.04	0.03
	26	3.0	2.1	0.11	3.25	0.01	0.01
	27	2.45	1.58	0.05	2.68	0.00	0.00
	28	2.18	0.98	0.07	2.86	0.00	0.01
	29	1.97	1.07	0.06	2.83	0.00	0.01
	30	1.98	1.31	0.13	2.99	0.00	0.01

TABLE 4

HOLLAND RIVER BASIN
WATER QUALITY MONITORING DATA - 1964-68

Location	Coliform	BOD_5	Dissolved Oxygen		Solids		Phosphorus as PO_4		Nitrogen as N			
	Org. per 100 ml.	Avg.	Avg.	Range	Total	Susp.	Total	Sol.	Free NH_3	Total Kjel.	NO_2	NO_3
HOA - 19.3 Aurora Ck. at Hwy.11 Station 6	83,000 (26)	28.7 (27)	6.5 (17)	1.2 (min.) 10.0 (max.)	794 (25)	67 (26)	6.1 (19)	2.7 (19)	7.4 (19)	14.0 (19)	0.6 (19)	0.3 (19)
HO - 15.4 Holland River at Mullock Road Station 10	800 (15)	8.2 (16)	6.5 (7)	3.0 (min.) 12.0 (max.)	546 (16)	19 (16)	2.92 (14)	2.17 (14)	3.4 (14)	4.9 (13)	0.2 (14)	0.3 (14)
HO - 12.4 Holland River at Herald Road Station 17	10,500 (26)	7.5 (28)	8.2 (17)	3.2 (min.) 13.5 (max.)	519 (25)	17 (28)	4.6 (19)	3.7 (19)	2.2 (20)	4.2 (19)	0.4 (20)	1.3 (19)
HO - 6.6 Holland River at Queensville Road Station 25	236 (15)	9.0 (16)	16.1 (7)	11.0 (min.) 25.0 (max.)	495 (15)	26 (15)	2.50 (14)	1.65 (14)	0.5 (14)	3.2 (14)	0.2 (14)	1.0 (14)
HOS - 7.2 Schomberg River at Hwy. 11	725 (16)	5.5 (16)	9.3 (7)	6.0 (min.) 10.0 (max.)	382 (16)	24 (16)	0.64 (14)	0.29 (14)	0.2 (13)	1.3 (13)	0.0 (14)	0.3 (14)

- All values expressed as milligrams per litre unless otherwise noted.
- Number of samples collected shown in brackets.

ABBREVIATIONS

mg/l	-	milligrams per litre
mgd	-	million gallons per day (Imperial)
cfs	-	cubic feet per second
BOD_5	-	5-day biochemical oxygen demand
STP	-	sewage treatment plant

Date Due

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